

There are only 10 types of people in the world          Those who understand binary and those who don't

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# PROBLEM SOLVING PARADIGM



Riddles / Puzzles / Paradoxes / Anomalies / Fallacies / Inconsistencies / Counter-Intuitive Behavior / etc.

# PROBLEM SOLVING PARADIGM

**Complexity** Human necessity to deal-with (simplify) the complexity in the problem-space

**Simplification of Science -&- Science of Simplification**

**Combinatorial Complexity**

**Organized-Complexity**  
(Systems Approach)

**Unorganized-Complexity**  
(Statistical Approach)

**What How (WHY) Where When Which / Who ...**

## A Problem Solving Scenario

**Trial & Error (hit or miss) - as a default approach**

...

**An iterative approach incorporating a sequence of some well defined steps/stages with the option at every step/stage for a possible iteration of any earlier subsequence**

...

**Detection / Description**

**Identification / Classification**

**Representation / Formulation / Modeling**

**Solution: Analysis / Simulation / Synthesis / Design / Optimization / Control**

**Testing / Interpretation / Evaluation**

**Implementation**

## **SOME ISSUES OF CONCERN**

**Missing the relevant detail (Signal) -and/or- Picking the irrelevant detail (Noise)**

**Observer – Observation – Observed : Scope, Resolution/Granularity**

**Modeling Errors - Implicit / Hidden Assumptions**

**Errors of Decomposition -&- Errors of Composition**

**Complementarity - Interdependence, Self-Reference / Circularity / non-Transitivity**

**Performance: Robustness, Reliability, Efficiency, Safety, . . .**

**Dynamics: Regulation, Adaptation, Control, Stability, Equilibrium, Convergence**

**Optimization**

**Uncertainty**

**. . .**

## Colin R. Blyth's Paradox

### EXAMPLE:

**A:** rated 3-out-of-6 with 100% weightage.

**B:** rated 2-out-of-6 with 55% weightage, 4-out-of-6 with 25% weightage, 6-out-of-6 with 20% weightage.

**C:** rated 1-out-of-6 with 52% weightage, 5-out-of-6 with 48% weightage.

[Higher rating indicates better preference]

Determine the rank-order-of-preference for deciding on the best, second-best and the third.

### Three Approaches:

Compare the weighted average ratings for each of the candidate-choices A,B,C (evaluated one at a time);

{A=3.00; B=3.30; C=2.92}

Result: **B>A>C.**

Compare two at a time: (i)  $P\{A > B\} = 0.55$ ;

(ii)  $P\{B > C\} = 0.616$ ;

(iii)  $P\{A > C\} = 0.52$ ;

Result: **A>B>C.**

Compare three at a time: (i)  $P\{(A>B)\&(A>C)\}=0.286$ ; (ii)  $P\{(B>A)\&(B>C)\}=0.330$ ; (iii)  $P\{(C>A)\&(C>B)\}=0.384$ ;

Result: **C>B>A.**

## Simpson's Reversal Paradox -OR- Discrimination Statistics [Yule-Simpson Effect]

	M	F		M	F		M	F	
S	11	70	+	80	19	=	91	89	S
R	9	30		20	1		29	31	R
	M	F		M	F		M	F	
S	1	5	+	20	9	=	21	14	S
R	19	45		30	11		49	56	R
	M	F		M	F		M	F	
S	1	5	+	45	19	=	46	24	S
R	19	45		5	1		24	46	R
	M	F		M	F		M	F	

	M	F		M	F		M	F	
S	10	30	+	70	40	=	80	70	S
R	30	70		30	10		70	80	R
	M	F		M	F		M	F	
S	50	25	+	15	30	=	65	55	S
R	50	25		35	70		85	95	R
	M	F		M	F		M	F	
S	6	11	+	9	4	=	15	15	S
R	4	9		11	6		15	15	R
	S	F		M	F		M	F	

$$\frac{P(A|B)}{P(A|B')} = \frac{P(C|B) \cdot P(A|BC) + P(C'|B) \cdot P(A|BC')}{P(C|B') \cdot P(A|B'C) + P(C'|B') \cdot P(A|B'C')}; \text{ and}$$

## Non-Transitivity $\Rightarrow$ Cycle / Circularity

Team-A : scores 100 always.

Team-B : scores 101 three-fourth-of-the-time and 97 one-fourth-of-the-time.

Team-C : scores 102 half-of-the-time and 98 half-of-the-time.

Team-D : scores 103 one-fourth-of-the-time and 99 three-fourth-of-the-time.

[Higher score indicates better performance]

Weighted-time-average-scores:

**wtas-A = wtas-B = wtas-C = wtas-D = 100.**

**$P\{A < B\} = 0.7500$ ;  $P\{B < A\} = 0.2500$ ;**

**$P\{A < C\} = 0.5000$ ;  $P\{C < A\} = 0.5000$ ;**

**$P\{A < D\} = 0.2500$ ;  $P\{D < A\} = 0.7500$ ;**

**$P\{B < C\} = 0.3750$ ;  $P\{C < B\} = 0.6250$ ;**

**$P\{B < D\} = 0.5625$ ;  $P\{D < B\} = 0.4375$ ;**

**$P\{C < D\} = 0.3750$ ;  $P\{D < C\} = 0.6250$ ;**

Observe the cycles arising from non-transitivity:

**$(A < B < D < A)$ ;**

**$(D < C < B < D)$ ;**



## Self-reference / Circularity

[Liar Paradox]

- (1) “This sentence is *False*”
- (2) "This sentence is not *True*"
- (3) "This sentence is *Only False*"
- (4) “This sentence contains seven words”
- (5) “This sentence does not contain seven words”
- (6) A: “Sentence-B is *True*”;    B: “Sentence-A is *False*”
- (7) S1: "Sentence S2 is *False*";    S2: "Sentence S3 is *False*";    S3: "Sentence S1 is *False*"

## Self-reference / Circularity

**ESCHER DRAWING HANDS DREW HANDS DRAWING ESCHER**



**ESCHER DRAWING HANDS DREW HANDS DRAWING ESCHER**

# SYMMETRY

## Effect of G:R:A:N:U:L:A:R:I:T:Y on Symmetry Properties

Palindrome-String : String-Sf = String-Sr

S↓ p→	p1	p2	p3	p4	p5	p6	p7	p8	p9
Sf:	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Sr:	Q9	Q8	Q7	Q6	Q5	Q4	Q3	Q2	Q1

Sf:	M	A	L	A	Y	A	L	A	M
Sr:	M	A	L	A	Y	A	L	A	M

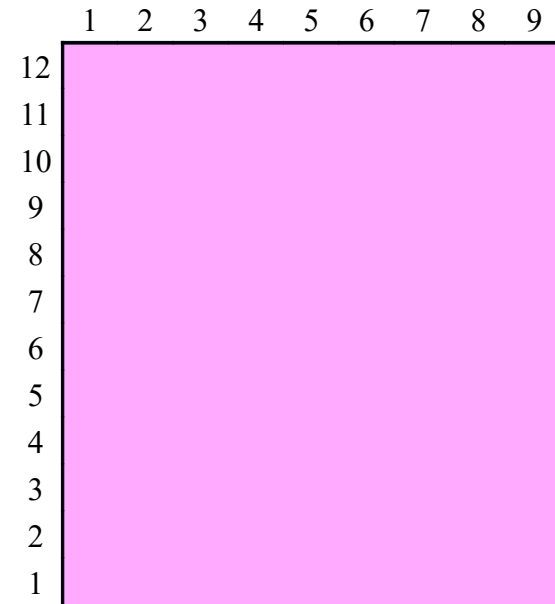
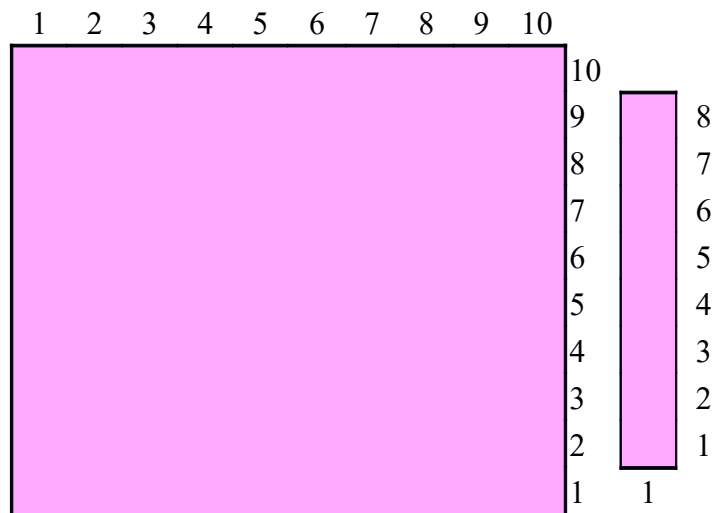
S↓ p→	p1	p2	p3	p4	p5	p6	p7
Sf:	Escher	drawing	hands	drew	hands	drawing	Escher
Sr:	Escher	drawing	hands	drew	hands	drawing	Escher

## CARPET CUTTING & STITCHING PUZZLE

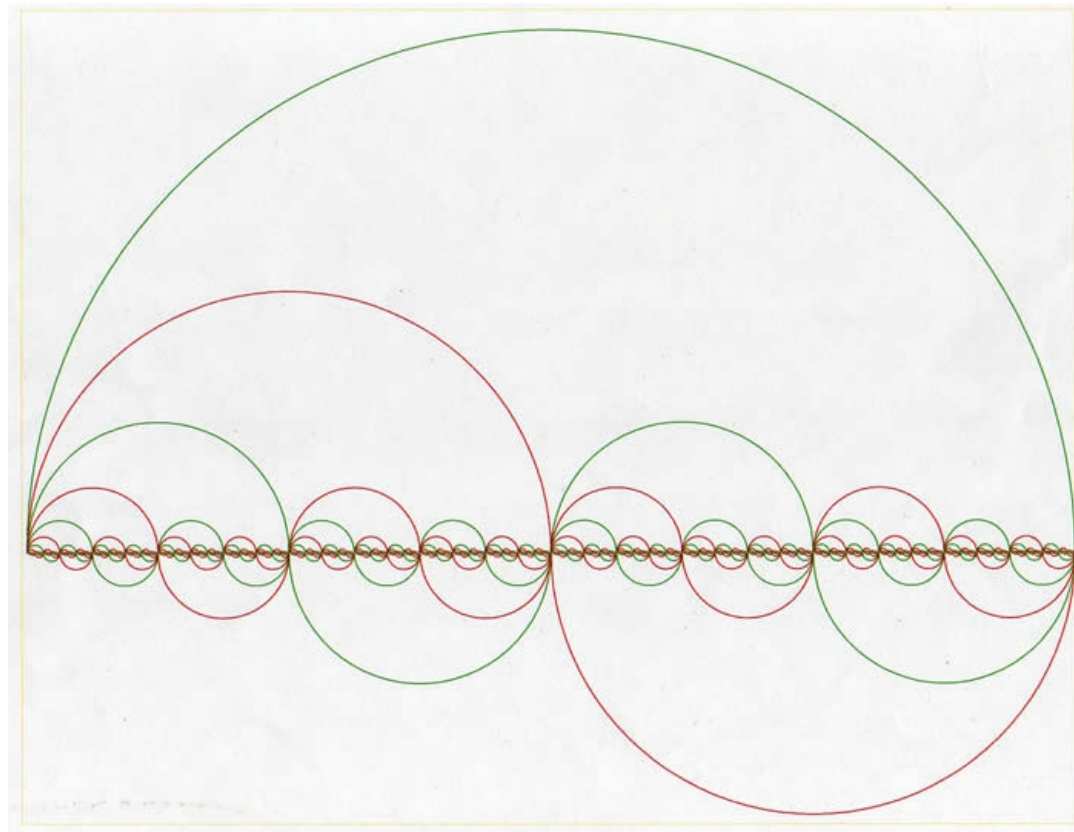
Given : One piece of Carpet **10x10** size, and another piece of Carpet **1x8** size;

Goal: To make a single piece carpet **9x12** size;

Condition: Carpet **1x8** is *not to be cut* at all, whereas Carpet **10x10** can be *cut into no more than two pieces*, before joining.



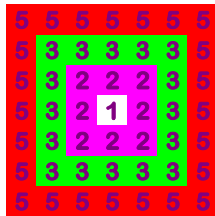
## Circumference - Diameter Paradox



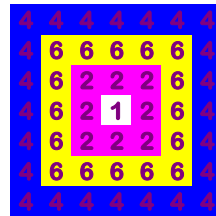
## ! THE MOST DIFFERENT from THE MOST SIMILAR !

Q: Identify the one figure that is (1) *most different* from (2) *most similar* to - the others, among the following set of five given figures (A), (B), (C), (D), (E) - [you may chose either Set-I or Set-II]. Explain / Justify your answers.

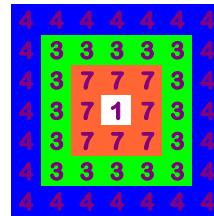
Set-I



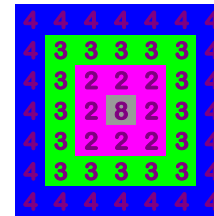
A



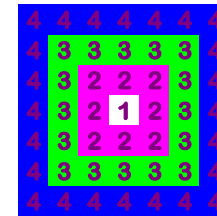
B



C



D



E

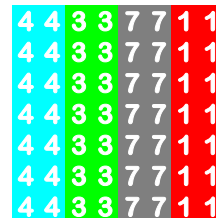
Set-II



A



B



C



D



E

. . . **Mystery** . . . **Amazement** . . . **Wonder** . . . . . **to be resolved** . . .



. . . keeping . . . the wonderful . . . undisturbed . . .

[illegible]